

each vertical compartment including an upper fluid inlet port located in the top of the compartment, the inlet ports being in fluid communication with the interior of the compartments and an external fluid source;

each vertical compartment being equipped with an upper bed disposed inside each compartment, the beds being proximate to the upper end of the compartments and below the inlet ports;

the upper beds having fluid distribution nozzles, wherein fluid received from the inlet ports is directed into the compartments at a controlled flow rate;

each compartment further including an outlet port for backwashing, each outlet port being disposed adjacent to and below each upper bed, wherein the outlet ports remove particulate matter larger than the upper bed nozzle openings;

the U-tube portion between the compartments including a lower fluid inlet port, wherein the lower fluid inlet port is in fluid communication with both the first and second vertical compartments; and;

an adsorbant resin layer disposed within each vertical compartment, wherein a free board is defined between a top level of the adsorbant resin layer and the upper bed in each compartment, whereby the free board allows the resin layer to expand and contract during the liquid separation process.

7. (New) The liquid separation apparatus of claim 6, wherein the vertical compartments further include a sight glass for monitoring the level of the resin layer.

8. (New) A liquid separation process utilizing the apparatus of claim 6, wherein the inlet and outlet ports are in fluid communication with a service fluid supply, a regenerant fluid supply, a backwash fluid supply, and a pump for pumping the service fluid, regenerant fluid, and backwash fluid through the apparatus; the process comprising the steps of:

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pumping service fluid through the inlet port of the first compartment down through the adsorbant resin layer of the first compartment and up through the adsorbant layer of the second compartment, the filtered fluid exiting the apparatus through the inlet port of the second compartment;

regenerating the adsorbant resin layers by pumping regenerating fluid through the inlet port of the second compartment down through the adsorbant resin layer of the second compartment and up through the adsorbant layer of the first compartment, wherein the regenerant fluid exits the apparatus through the inlet port of the first compartment; and

backwashing the apparatus when the pressure drop of the service fluid increases to a predetermined level.

9. (New) The liquid separation process of claim 8, wherein the step of backwashing when the pressure drop of the service fluid reaches a predetermined level, comprises:

backwashing the resin in the first compartment by pumping the backwash fluid at a controlled flowrate through the inlet port of the second compartment and outflowing the fluid through the outlet port of the first compartment; and

backwashing the resin at the second compartment by pumping the backwash fluid at a controlled flowrate through the inlet port at the first compartment and outflowing the fluid through the outlet port of the second compartment.

10. (New) The liquid separation process of claim 8, wherein the step of backwashing when the pressure drop of the service fluid reaches a predetermined level, comprises:

backwashing the resin in the first compartment by pumping the backwash fluid at a controlled flowrate through the U-tube inlet port and outflowing the fluid through the outlet port of the first compartment; and

backwashing the resin at the second compartment by pumping the backwash fluid at a controlled flowrate through the U-tube inlet port and outflowing the fluid through the outlet port of the second compartment.

11. (New) The liquid separation process of claim 8, wherein the step of backwashing when the pressure drop of the service fluid reaches a predetermined level, comprises:

opening simultaneously the outlet ports in both the first and second compartments;

and

pumping the backwash fluid through the U-tube inlet port and outflowing the backwash fluid through the outlet ports of each compartment.

12. (New) An apparatus for conducting liquid separation utilizing an ion exchange process, the apparatus comprising:

at least one vertical liquid separation column, wherein each column comprises a single chamber;

upper and lower service fluid inlet ports located at each end of the column;

upper and lower beds disposed inside the column, the upper bed being below the upper inlet port, the lower bed being above the lower inlet port;

the beds having fluid distribution nozzles, wherein fluid received from the inlet ports is directed into the vertical column at a controlled flow rate;

an outlet port for backwashing, the outlet port disposed adjacent to and below the upper bed, wherein the outlet port removes particulate matter larger than the bed nozzle openings;

and
an adsorbant resin layer disposed within the vertical column, wherein a free board is defined between a top level of the adsorbant resin layer and the upper bed, whereby the free board allows the resin bed to expand and contract during the liquid separation, regeneration, or backwashing processes.

13. (New) A liquid separation process utilizing comprising:

providing a liquid separation apparatus comprising a vertical column comprising a single chamber, the column having upper and lower fluid inlet ports, an upper drain bed disposed below the upper inlet port and a lower drain bed disposed above the lower inlet port, an upper outlet port, the upper outlet port disposed adjacent to and below the upper bed, and an adsorbant resin layer disposed within the vertical column such that a freeboard is defined between a top level of the adsorbant resin layer and the upper bed, wherein the inlet and outlet ports are in fluid communication with a service fluid supply, a regenerant fluid supply, a backwash fluid supply, and a pump for pumping the service fluid, regenerant fluid, and backwash fluid through the apparatus;

pumping service fluid through the upper inlet port down through the adsorbant resin layer, the service fluid exiting through the lower inlet port;

regenerating the adsorbant resin layer by pumping regenerating fluid through the lower inlet port up through the adsorbant resin layer, the regenerant fluid exiting the vertical column through the upper inlet port; and

backwashing the apparatus when the pressure drop of the service fluid increases to a predetermined level.

14. (New) The liquid separation process of claim 13, wherein the step of backwashing when the pressure drop of the service fluid reaches a predetermined level, comprises:

backwashing the resin by pumping the backwash fluid at a controlled flow rate through the lower inlet port and outflowing the fluid through the upper outlet port.

REMARKS/ARGUMENTS

Claims 1-5 were rejected. In response, Applicant has cancelled these claims and added new claims 6-14. New claims 6-14 do not narrow the literal scope of the original claims. The original claims were translated into English from an international application and contained translation errors.